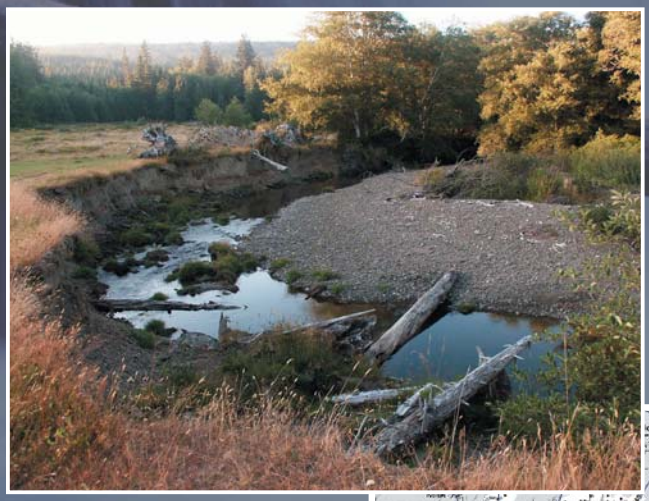
Prepared for Clallam County
and the WRIA 20 Planning Unit

Multi-Purpose Storage Assessment
Water Resources Inventory Area 20



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June 30, 2005

Golder Associates

Golder Associates Inc.

18300 NE Union Hill Road, Suite 200
Redmond, WA USA 98052-3333
Telephone (425) 883-0777
Fax (425) 882-5498
www.golder.com

June 30, 2005

Our Ref.: 043-1130-100.2400

Clallam County Environmental Health
223 E. 4th Street, Suite 14
Port Angeles, WA 98362

Attention: Val Streeter, WRIA 20 Watershed Coordinator

RE: WRIA 20 WATERSHED PLANNING
MULTI-PURPOSE STORAGE ASSESSMENT REPORT

Dear Val:

Enclosed is the WRIA 20 Multi-Purpose Storage Assessment Report. The subject matter covered by this assessment truly reflects the "Multi-Purpose" intent of the grant, including:

- Assessment of the geomorphology of the Big River drainage in its relationship to groundwater and wetlands storage;
- Groundwater and conventional infrastructure storage for the City of Forks; and,
- Reservoir storage for flow augmentation to sustain anadromous salmonid runs on the Hoh River.

It also addresses Washington State's "Water for Fish, Water for People" theme. Much work has been initiated by this study in a short period of time, and we hope that it will provide a good foundation for future work.

We very much appreciated the opportunity and enjoyed conducting this work on behalf of Clallam County and the stakeholders of the Planning Unit.

Sincerely,

GOLDER ASSOCIATES INC.

R. Anderson for

Chris Pitre, P.G.
Associate, Water Resources

Golder Associates Inc.

18300 NE Union Hill Road, Suite 200
Redmond, WA USA 98052-3333
Telephone (425) 883-0777
Fax (425) 882-5498
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REPORT ON

STORAGE ASSESSMENT FOR WRIA 20

Funded by Grant No. G0500029, provided by the Washington Department of Ecology under the Watershed Planning Act, RCW 90.82

Submitted to:

Clallam County
and
WRIA 20 Watershed Planning Unit

Submitted by:

Golder Associates Inc.
Redmond, Washington

Chris V. Pitre, P.G.
Senior Project Manager, Water Resources

Andreas Kammereck, P.E.
Senior Geomorphologist

Distribution:

25 Hardcopies, 15 CDs - Clallam County
1 Copy - Golder Associates Inc.

June 30, 2005

043-1130-100

EXECUTIVE SUMMARY

This supplemental storage assessment was undertaken at the direction of the WRIA 20 Planning Unit to support development of a watershed plan. Work was divided into two steps, with the first step focused on potential applications of Aquifer Storage and Recovery (ASR) and an identification of possible alternatives for more detailed assessment under the second step. The second step considered a range of storage alternatives, including effects of stream channel dynamics on floodplain groundwater storage, groundwater and conventional infrastructure storage related to municipal water supply, and groundwater and surface water reservoir storage to maintain adequate flows for fish habitat.

Aquifer Storage & Recovery

Water for enhanced groundwater recharge is available during the winter and spring runoff periods. The concept considered was to recharge a portion of this water to groundwater such that seepage back to streams would increase summer low flows. Recharge mechanisms considered included direct injection through wells, and infiltration from ground surface. Direct injection requires water quality equivalent to potable standards to minimize clogging of injection wells by suspended sediment and biological growth. Treatment of surface water to these standards has capital costs of approximately $1,000,000 per 1.5 cubic feet per second (cfs) capacity. Recharge to floodplains would require diversion structures on the river and conveyance channels to an appropriate infiltration site.

Increasing groundwater storage through artificial recharge was considered primarily for maintaining summer baseflows in streams. Available storage in the aquifers of WRIA 20 is practically excluded from bedrock areas, and limited to alluvial sediments in valleys. The storage capacity of the aquifers is restricted by the limited horizontal and vertical extents of the alluvial sediments. These aquifers are largely unconfined and well connected to streams. For these reasons, water recharged during the winter and spring runoff periods is expected to drain back to streams too quickly to realize the desired benefits of increased streamflows during critical low flow periods in the late summer and early fall.

Conventional ASR in WRIA 20 involving the direct injection of water into an aquifer is not considered feasible due to the cost of required treatment. Recharge to floodplains would require diversion structures on the river and conveyance channels to recharge sites.

Big River Geomorphology

The role of groundwater storage in maintaining summer low stream flows and floodplain wetlands is the focus of this portion of the storage assessment. The Big River stream channel has been modified by changes in land cover and land use, as well as the removal of large woody debris in the 1950s. This has resulted in down cutting of the stream channel relative to adjacent floodplains (channel degradation) by up to six feet in some reaches. Stream channel degradation has effectively enhanced the drainage of groundwater stored in the floodplain, possibly causing higher peak flows and lower summer flows. This also lowers the ambient water table, which can significantly alter the function of floodplain wetlands.

The approach taken in the assessment of the geomorphology of Big River was to delineate reaches and identify controlling factors within each reach. The Big River was delineated into six reaches of different characteristics, for which actions have been identified for consideration in a watershed plan:

- **Headwaters Reach:** Steep slopes, heavily forested. The primary influence is expected to be erosion.

Primary Recommended Action: Implementation of Road Maintenance and Abandonment Plans (RMAPs).

- **Falls Reach:** Dynamic, transitional/response reach. Site of possible recharge to the alluvial floodplain sediments.

  Primary Recommended Action: None. The dynamic nature of this reach precludes effective control. This reach will be more responsive to actions undertaken in upstream and downstream reaches as opposed to actions within this reach.

- **Boe Creek Reach:** Reach of highest residential density. Riparian zones cleared in parts for agricultural use, resulting in removal of recruitment material for large woody debris (LWD).

  Primary Recommended Action: Restore riparian vegetation through voluntary enrollment by agricultural land owners into the United States Department of Agriculture's Conservation Reserve and Enhancement Program (CREP) and Conservation Reserve Program (typically administered through the local conservation district).

- **Solberg Creek Reach:** Transitional/response reach.

  *Primary Recommended Action***:** None. Maintenance of stream channel function will be achieved by restoration of riparian vegetation and associated LWD recruitment material in the upstream reach (Boe Creek reach), and accelerated reintroduction LWD in the downstream reach (Highway reach).

- **Highway Reach:** Constrained in parts by Hoko-Ozette Road. Reach of most intense historical removal of large woody debris.

  Primary Recommended Action: Accelerate natural recovery by installation of large woody debris to control and possibly reverse channel down cutting.

- **Lake Reach:** Low gradient influenced by backwater from Lake Ozette.

  Primary Recommended Action: Survey the reach for candidate sites for re-establishment of side-channel habitat.

More detailed descriptions of these actions are provided in the text, along with additional actions. Actions to modify streams result in changes at the reach scale (as opposed to the restoration site alone). The analysis of streams at the reach scale and identification of controlling factors will better ensure successful implementation of remediative actions. Without considering reach scale effects, remediation efforts may simply transfer the target problem elsewhere in the channel, or create unintended effects. The approach taken in this analysis (i.e., delineate reaches and identify controlling factors within each reach) may be applied to other streams in WRIA 20.

City of Forks Municipal Water Supply

The City of Forks relies on groundwater storage for 100% of its municipal water supply. A range of management tools are available to ensure the reliability and security of that supply, including protection of groundwater, and diversification of sources. Wellhead protection areas were delineated using a three-dimensional steady state groundwater model.

Installing a new well will diversify the existing array of municipal water supply wells to improve system redundancy and reliability. It will also allow the City to more fully exercise existing water rights. Such a well could be permitted with water rights by adding it as an additional point of withdrawal to existing water rights.

Current demand estimates (Polaris, 1999) indicate that new water rights will be needed in the near future (e.g., within five years). These estimates may be conservative, and new water rights may not be needed for an extended period of time, depending on water demand growth rates (e.g., new industrial demand). Applications should be submitted now for future water rights.

In order to prevent contamination of groundwater north of the river, we recommend that the Grafstrom well in the Forks Industrial Park be abandoned in accordance with WAC 173-160-381. If other unused wells are identified within the City's service area, they should be properly abandoned as well.

The current operation of the wells consists of pumps whose flow is maintained significantly below their designed rates by valves. This creates an unnecessarily high energy bill. Simple energy cost auditing may indicate significant cost savings through the purpose of appropriately sized submersible pumps.

Given the age of the wells, a video inspection should be conducted on any of the City wells in which pumps are pulled for maintenance. A video inspection of Well 2 from 2004 indicated that the screen was in fairly good shape. However, there appeared to be staining around a casing joint, perhaps indicating that one of the welds might be compromised. Unfortunately the camera could only record downhole views (not sideways) and no depth information was provided on the video in order to determine the depth of the casing joint.

Before groundwater development occurs at the Quillayute Airport, a hydrogeologic investigation should be conducted. In order to do this, a close working relationship with the citizens living near the airport should be established to facilitate access to private wells. This work could be conducted in conjunction with the Army Corps of Engineers.

A hydrogeologic investigation of this area would entail gathering well logs, collecting water level measurements, collecting samples for water quality analysis, perhaps limited pumping tests could be conducted on existing wells.

Water Supply for Hoh River Fish

The Hoh Indian Tribe relies almost exclusively on salmon runs of the Hoh River for cultural and economic purposes. There have been several years (e.g., 1987 and 2002) in which river flows have dropped to levels that impaired the upstream passage of returning adult Chinook at River Mile 3.0 (G&L Shake Road crossing) of salmon returning for spawning. The impact of a single year's significant reduction of fish spawning is compounded by reduced production in subsequent return years. The frequency of such low flows is anticipated to increase under predicted global warming conditions, and may present a significant challenge to the continuing viability of salmonid runs. Options considered for maintaining the viability of salmon runs were hatchery supplementation, streamflow augmentation and channel modification.

Hatcheries offer the capacity to directly support salmonid runs in the Hoh River. Fall Chinook are the species currently most affected by low flows. In the event of frequent recurrence of low flows, natural salmonid runs may not be self-sustaining.

Management actions to maintain salmon production on the Hoh River include periodic augmentation of streamflow during critical low flow periods, and/or operating a fish hatchery. Four sites were evaluated with respect to the quantities of water that could be impounded and released, based on topography, precipitation, and assumed release schedules.

Channel modification has been effectively used in WRIA 20 in recent years. However, it requires a significant response effort, and typically only addresses known points of passage barriers. New points may appear due to natural dynamic channel migration in the future in locations that are not accessible. Therefore, channel modification offers limited reliability as an option for maintaining salmon runs in the longer term.

Limiting factors to salmonid habitat other than low flows were not addressed in this assessment.

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